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BULLETIN
OF THE
TORREY BOTANICAL CLUB.

Vol. XV.]

New York, August 2, 1888.

[No. 8.]

The Fruit of *Calycanthus*, L.

A recent close inspection of several hundred ripe pods of *Calycanthus glaucus*, Willd., gathered on the Cumberland Mountains in Eastern Tennessee, enables me to give a somewhat detailed account of this rare and interesting fruit. The best description of it known to me is that of Nuttall (Gen. N. A. Pl., p. 311).

“Capsule turbinate,” says this delightful old botanist, “as large as a small pear, marked with vestiges of the calycine laciniae, at length becoming perfectly dry, but never opening.” A few of the pods I examined were almost typically turbinate, perfectly flat across the top and tapering to the base, but curving slightly outwards. The prevailing shape, however, was more nearly obovoid or pyriform, the upper third being rounded. Some were slender and elongated, resembling small cucumbers, and one was distinctly ovoid, broadest below the middle and tapering upwards. Many were very irregularly protuberant or collapsed, these variations in form depending on the development or abortion of the ovaries within, and several were remarkably incurved, the summit and base almost meeting after the fashion of a campylotropous ovule. This curious form results from the development of two or three ovaries one above the other and the abortion of all the rest. Taking the extremes alone, these pods would certainly have seemed to belong to two or three distinct species, but the complete gradation of intermediate forms made it impossible to draw any specific line. As to size, Nuttall’s rather vague “as large as a small pear” (or Wood’s “size of a fig”) may be taken as a correct average statement, but as a matter of fact the pods examined, all mature and containing perfect achenia, ranged from half an inch to over three inches in length, and from one-third of an inch to an inch and a half in greatest diameter. The

bulkiest were barely two inches long, those of greater length being invariably somewhat attenuated (cucumber-shaped).

Baillon, in the *Histoire des Plantes*, Vol. I., figures the fruit of *C. levigatus*, Willd., as an oblong spheroid, with a distinct cylindrical neck, like that of a bottle. None of the pods I examined showed exactly this form. The summit in some cases was tapering-elongated, quite commonly a little protuberant, sometimes perfectly flat, and in a few instances distinctly umbilicate. (Wood's "involute at top" indicates that his specimens were of this latter form.) Nuttall's "marked with the vestiges of the calycine laciniae" is equivalent to Wood's "longitudinally veined." These markings are really the ridged margins of the adnate portion of the bracts, the free portion being entirely deciduous. The sepals and petals are also deciduous, but their bases persist, forming a ring often obscure but sometimes quite distinct. Another ring is formed within this by the short, persistent, pubescent and usually more or less recurved filaments. It is worthy of note that these enter the orifice of the fruit and are adnate to its inner surface. In very rare cases this orifice is large enough to allow the ripe achenia to escape; most generally it is too small for this, and not seldom it appears quite closed. Nuttall's statement that the pod never opens is therefore strictly true only in the sense that it never dehisces or ruptures in any way. "Becoming perfectly dry" is a correct characterization; "and rigid" might properly have been added, as they resist considerable pressure but break finally instead of yielding. Nuttall does not note the color. Most of those examined were of a blackish weather-beaten brown. In fact, taken in bulk, the pods of *Calycanthus* at a casual glance closely resemble the perfectly ripe fruit of *Juglans cinerea*, L., though far less uniform in either size or shape. The original color at maturity, judging from the fresher specimens, is an orange brown.

The wall of the pod is thin, and the large cavity is ordinarily about half filled by the loose achenia. When shaken, the resemblance to a baby's rattle is very marked. The inner surface is of a rich reddish-brown color, with a slight and scattered silvery-white pubescence. The adnate filaments mark the surface above with radiating ribs. In well developed specimens slight ridges

rise spirally from the base, intersecting each other, and forming shallow, rhombic hollows. The lower angles of these are marked by the white spatula-shaped scars left by the detached achenia. To my surprise these indicated two distinct phyllotaxies, the $\frac{1}{8}$ and the $\frac{8}{21}$. The achenia are more commonly sessile, or nearly so, but are also sometimes raised, not on a stipe, but on a curious rough pedestal—a shapeless hardened mass of tissue, apparently deposited by sheer excess of vital force. Nuttall's account of the achenia, or "seeds" as he naïvely calls them, is sufficiently full and accurate to be worthy of quotation: "Brown, nearly as large as horse-beans, naked, smooth, shining, about sixteen in each utriculus, of a roundish oblong form, marked with a longitudinal suture and a central hilum; shell hard and cartilaginous, perisperm none or a small central portion, gelatinizing when moistened; radicle descendant, cotyledones convolute, white and large, of an oleaginous bitter taste." The color is that of freshly browned coffee, and I have twice known the *Calycanthus* achenia to be mistaken for coffee beans. The length varies from a half to a third of an inch, and the diameter is about half as great. The weight ranges from three to five grains. They are not strictly naked, but have commonly a little spreading silvery pubescence, especially about the base. The number is greater than Nuttall represents. In ten pods of the average full size I counted respectively, 16, 17, 17, 18, 19, 20, 20, 26, 30 and 31, in all 214, or an average of over 21. The pod containing 31 had also five or six abortive ovaries, indicating about 35, or at most 40, as the maximum possible number. The minimum is one, several minute pods being completely filled by a single fully developed achenium. Both sutures are well defined, the one next the wall being marked by a single crest, and the one towards the axis of the pod by two parallel crests with a slight furrow between. These are slender, sharp and more or less corrugate-wavy. The "hilum" (if the term may be used with reference to an achenium), is not central as in a bean, but is distinctly basal. In Gray's Structural Botany, the embryo of *Calycanthus* is figured with the radicle projecting considerably below the cotyledons. In the numerous seeds I dissected it was always entirely enclosed within their coiled bases. The cotyledons are so brittle, that even after

prolonged soaking they break into several pieces in unrolling. Their shape is evidently between cordate-orbicular and reniform. The testa is thin, yellowish, membranaceous, only slightly adherent, and marked by a slender but distinct raphe. The embryo is decidedly oleaginous, leaving an oily mark when crushed on paper, and, to my taste, is distinctly bitter, though not extremely so. The albumen, ("perisperm" of Nuttall), when present, forms a slender, more or less irregular plug, inserted in the top of the seed opposite the radicle.

The pods are evidently borne, as a rule at least, on two- (rarely four-) leaved stems, these leaves making the stems branches, instead of peduncles, and the inflorescence, strictly speaking, terminal instead of axillary. The pods persist through the winter, and are finally worn or torn off by wind and weather, like the fruit of *Platanus*. It is a curious fact that they are subject to the attacks of birds, several of those examined having large holes pecked in the side. The persistence of the peculiar and pleasant odor of the plant is also noteworthy, even the perfectly dry fruit being strongly aromatic when crushed.

The pods above described were sent me last November by Mr. J. H. H. Boyd, postmaster at Cagle, Tenn. In an accompanying letter Mr. Boyd made the following remarkable statement :

Hundreds of cattle and sheep have died here in the past five years from "bubby" [the eccentric local name of the shrub]. The seeds only are poisonous. When a brute gets a sufficient dose, from five to ten well filled pods, it makes for the nearest water and often falls dead while drinking, or it may live three or four weeks and then die. The symptoms are like those of a man extremely drunk, except that any noise frightens it. Stamp the ground hard, close to a brute poisoned with "bubby," and it will jump and jerk and tremble for several minutes. That is our method of telling when they have taken it. The eyes turn white and glassy, and while lying they throw back the head and look as if dead already. "Bubby" does not seem to hurt a brute so much if it cannot get water. Our best remedy is apple brandy, strong coffee and raw eggs poured down as soon as possible after finding. It is certain that "bubby" is the most poisonous of any shrub or weed in existence here, from the fact that when brutes have once eaten it, they will take it every time they can get it. It grows on every hillside, along all branches [creeks], in every fence corner and almost everywhere here.

Inquiries addressed to two other postmasters in the same county elicited replies fully confirmatory of Mr. Boyd's surprising assertions. In other words, three separate individuals, miles apart, with no opportunity for collusion, and with no apparent motive for deception, agreed in declaring that the fruit of *Calycanthus* was fatally poisonous to cattle. Nevertheless, their assertions were discredited because they were not scientific observers, because of the long-established reputation of the plant as perfectly harmless, and especially because, in an experiment made by Dr. T. F. Allen last December, the contents of two pods, administered to a dog, produced no visible effect upon the animal. In this state of the case, and in view of the difficulty of making experiments here upon cattle and sheep, the evidence of a competent local authority became very desirable. This is furnished in a letter dated June 11, 1888, from Dr. B. W. Sparks, of McMinnville, Tenn., who writes in the following unequivocal strain :

In regard to the "bubby," "sweet shrub," (*Calycanthus glaucus*, Willd.), if you ask me, "Do I believe this plant to be poisonous to cattle and sheep?" most assuredly it is. It will poison cattle, sheep, goats, deer and all other ruminating animals, but does not have any effect on the horse, mule and ass. At least this is my experience. It will poison the squirrel, rat and dog, when ground or unground. I cannot speak for the hog family. I have known and made many experiments on rats and dogs; it is as sure death to them as strychnine or arsenic; symptoms in over-doses identical with those of strychnine, which I need not repeat. In my opinion it has an alkaloid allied to strychnia.

This alkaloid, named calycanthine, has been successfully extracted by Dr. R. G. Eccles, who also detected traces of a second alkaloid, provisionally termed calycanthoidine.

Upon the whole, despite the negative result of Dr. Allen's experiment (with an evidently insufficient dose), it seems now pretty well established that the seed of *Calycanthus* contains a virulent toxic quality. Some further scientific experiments are still very desirable, however, to determine fully its exact character, the nature and limitation of its effects, and especially its possible value as a medicine.

E. E. STERNS.